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Xiaolin Ji[1,2], Corinne Mandin[1,*], Olivier Ramalho[3], Olivier Le Bihan[1], Jean-Claude Pairon[2], Laurent Martinon[4] and Denis Bard[5]

[1]National Institute for Industrial Environment and Risks (INERIS), France
[2]Paris XII University / INSERM Unit 841, France
[3]Scientific and Technical Centre for Building (CSTB), France
[4]Inhaled Particle Laboratory (LEPI), France
[5]School of Advanced Studies in Public Health (EHESP), France

[*]*Corresponding email: Corinne.Mandin@ineris.fr*

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Introduction

Non engineered nanoparticles (NP), also called ultrafine particles (∅ < 100 nm), have numerous sources in the atmosphere as well as indoors (e.g. traffic, cooking…). To date studies on NP levels in ambient and indoor air are scarce. The NANOP project aims at assessing nanoparticle levels and their spatial and temporal variation in a domestic environment. The study is carried out in an experimental and fully controlled house.

Materials and Methods

First a ranking of domestic sources was performed, based on NP emission factors from a scientific literature review or previously assessed by the French Scientific and technical centre for building (CSTB) in experimental test chambers. Sources prevalence in dwellings, frequency and duration of use and possible particle toxicity were also taken into account.

Cooking, toasting, burning scented candles or incense, spraying air freshener, using hair spray, smoking, and vacuuming were operated independently as in real life conditions, in June 2007. While cooking, influence of air exhaust fan in the kitchen and mechanical ventilation was studied. A typical daily activity pattern was elaborated and reproduced 4 times in order to simulate real life and assess multiple source exposure. Particulate matter (PM2.5) analysers, condensation particle counters (CPC), scanning mobility particle sizer (SMPS), optical particle counters (OPC) and specific surface analyser (AeroTrack 9000®) were run in the kitchen, the living-room, the bathroom all on the same floor, the bedroom upstairs, and outdoor.

Results

Table 1. Maximum concentration (particle/cm3, 1 minute mean) measured with CPCs while cooking 2 steaks in the kitchen (gas stove).

	Kitchen down-stairs [27 m3] †	Bathroom down-stairs [5 m3] #	Bedroom up-stairs [29 m3] #
1	1,101,000	85,700 (27')	165,000 (10')
2	537,667	52,000 (25')	115,700 (7')
3	764,667	-	163,200 (11')

1: without exhaust hood, mechanical ventilation at low level (50 m3/h in the kitchen)
2: with exhaust hood, mechanical ventilation at low level
3: without exhaust hood, mechanical ventilation at high level (110 m3/h in the kitchen)
in brackets: time after peak in kitchen (minutes)
†: water CPC 3785, in photometric mode
#: CPC 3007, corrected for coincidence effect

Table 2. Maximum concentration (particle/cm3, 1 minute mean) measured with CPCs while operating different sources.

	Living-room, near the source †	Bedroom upstairs #
Air freshener (3 s)	30,660	-
Smoking one cigarette	71,900	19,000
Burning incense (15')	334,667	12,500
Burning candle (15')	52,650	10,600
Hair drying (5')	14,467	11,300
Vacuum cleaning (6')	16,025	11,300

Discussion

First results show high NP concentrations close to the sources, non negligible NP concentrations in adjacent and distant rooms, and a positive effect of exhaust fan and mechanical ventilation.